

HETERODERA GRAMINOPHILA IN FLORIDA.

R. N. Inserra¹, N. Vovlas², and R. P. Esser¹

Heterodera graminophila Golden and Birchfield, 1972, was described from barnyard grass (Echinochloa colonum (L.) Link) roots collected in Louisiana (2). Specimens of H. graminophila were found recently on roots of Panicum rigidulum Bosc. ex Nees (Fig. 1) collected along the eastern bank of the Ichetucknee river, in Florida. Because this is the first occurrence of H. graminophila in Florida and outside Louisiana, morphological and biological information on this cyst nematode is provided.

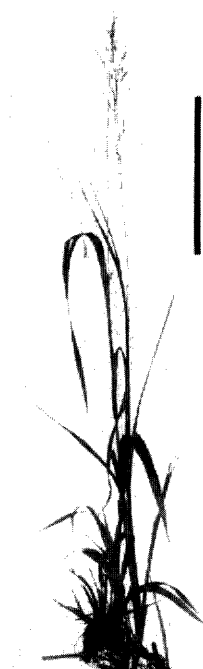


Fig. 1. A Panicum rigidulum plant. Scale bar = 4 cm.



Fig. 2. Photomicrograph of Heterodera graminophila lemon-shaped cysts. Scale bar = 305 μ m.

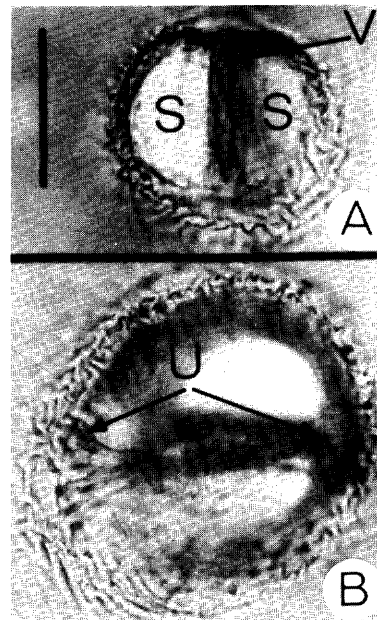


Fig. 3. Photomicrographs of vulval cones of Heterodera graminophila cysts. A) Vulval cone showing vulval slit (V) and semifenestrae (S). B) Vulval cone showing the underbridge (U). Scale bar = A) 48 μ m and B) 53 μ m.

Diagnostic characters: H. graminophila belongs to the "Heterodera goettingiana group" (4). It has lemon shaped cysts (Fig. 2) with vulval cones (Fig. 3) provided with two apertures (semifenestrae) (Fig. 3A), and a well developed underbridge (Fig. 3B). Heterodera graminophila cysts, like those of the other species of this group, do not have brown cuticular bodies (bullae) beneath the margins of the semifenestrae. Heterodera graminophila is closely related to H. cyperi Golden, Rau and G. S. Cobb, 1962, which is also present in Florida. It differs from H. cyperi in having cysts with longer and wider fenestrae than those of H. cyperi (52-58 and 43-50 vs. 27-35 and 20-28 μ m) and longer vulval slits (40-52 vs. 30-35 μ m) (Fig 3A)(4). H. graminophila possesses an inconspicuous anus. In contrast, H. cyperi cyst has a distinct anus that is delimited by circum-anal cuticular patterns (3). Cysts of H. graminophila also show irregularly arranged subcuticular punctation

¹Nematologists, Bureau of Nematology, P.O. Box 1269, Gainesville, FL 32602

²Nematologist, Istituto Nematologia Agraria, CNR, 70126 Bari, Italy

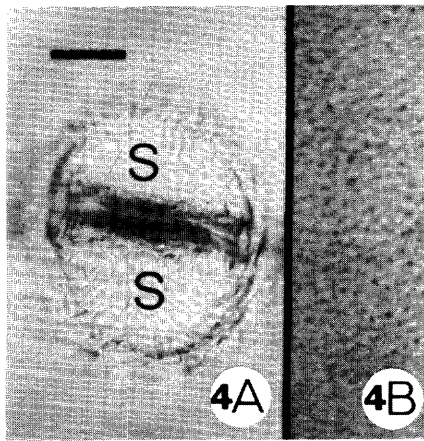


Fig. 4. Photomicrographs of cuticular ornamentation of Heterodera graminophila cysts. A) Wavy lines on semifenestrae (S). B) Irregularly arranged subcuticular punctation. Scale bar = 18 μ m.

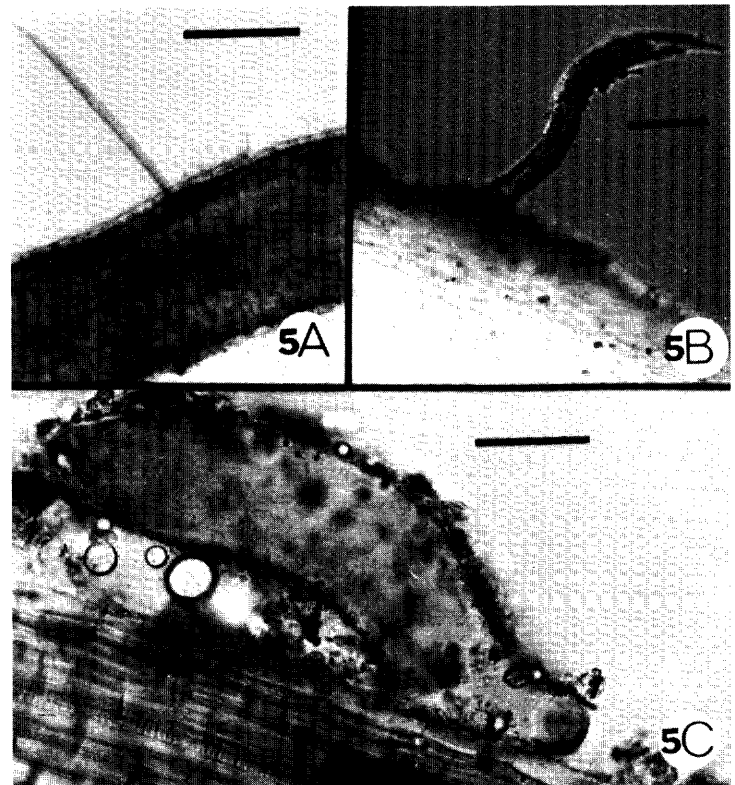


Fig. 5. Semiendoparasitic habit of Heterodera graminophila juveniles on Panicum rigidulum roots. A) J2 vermiform stage. B) J2 swelling stage, C) J4 stage. Scale bars = A) 170 μ m, B) 64 μ m, and C) 65 μ m.

(Fig. 4B) and wavy lines on the semifenestrae (Fig. 4A). H. graminophila differs from other Heterodera species from Florida (H. fici Kirjanova, 1954, H. glycines Ichinoe, 1952, H. leuceilyma Di Eduardo and Perry, 1964, and H. schachtii Schmidt, 1871) because it has cysts without bullae, which are present in the aforementioned species. It differs from the Cactodera species from Florida (C. cacti (Filipjev and Schuurmans Stekhoven, 1941) Krall and Krall, 1978, and C. weissii (Steiner, 1949) Krall and Krall, 1978) because its cyst has a well developed underbridge (Fig. 3) which is absent in Cactodera species (4).

Morphometric values of H. graminophila J2 from Florida differed from those of the Louisiana population (Tables 1,2,3). H. graminophila males and second-stage juveniles (J2) from Florida had shorter bodies and stylets than those from Louisiana (Tables 2 and 3). Cysts from Florida were smaller and with shorter underbridges than those from Louisiana (Table 1); however, length of their fenestrae and vulval slits did not differ from those from Louisiana (Table 1).

Host Plants: Barnyard grass, Johnson grass (Sorghum halepense (L.) Pers.) and rice (Oryza sativa L.) are the previously known hosts of H. graminophila. Panicum rigidulum is a new grass host of this parasite (Fig. 1).

Biology: Heterodera graminophila J2 penetrate with their entire body into host roots and feed in the stelar tissues (1,2). Then they become sedentary and swollen, developing to the adult stage after molts. Adult females burst from the root epidermis and protrude with the posterior portion of their body from the root surface. On P. rigidulum, swollen females retain the eggs inside their bodies and they become cysts (Fig. 1) without evidence of egg sac production. The number of eggs per cyst on this host is ca. 100. Adult males are vermiform and active. They leave the infected roots and migrate in the soil. Semiendoparasitic habits by juvenile stages are common in both Barnyard grass and P. rigidulum (Fig. 5).

Table 1. Morphometrics (μm) of Heterodera graminophila cysts from Louisiana and Florida.

	Body		Fenestra		Underbridge		Vulva slit	Shape
	Length	Width	Length	Width	Length	Width	Length	
Louisiana (3)	520-780 650	350-550 450	52-58	43-58	115-140	15-20	40-52 45	lemon
Florida	460-550 498	240-430 331	39-58 50	39-48 43	98-124 113	11-15 13	41-47 45	lemon

Table 2. Morphometrics (μm) of Heterodera graminophila males from Louisiana and Florida.

	Body Length	Stylet Length	DGO	Spicule Length	Tail Length	a	b	c
Louisiana (3)	850-1100 900	33.4-25.8 24.7	4.0-6.2 5.3	31-36 34	very short	28-37 32	5.3-6.5 6.0	- -
Florida	600-925 800	19.6-22.5 21.7	4.4-6.3 5.5	29-33 32	not measurable	28-35 33	6.4-8.6 7.6	- -

Table 3. Morphometrics (μm) of Heterodera graminophila J2 from Louisiana and Florida.

	Body Length	Stylet Length	DGO	Tail Length	Length of hyaline part of tail	Lateral lines
Louisiana (3)	380-460 430	21.8-23.5 22.7	5.6	57-67 62	25-38 32	3
Florida	374-412 391	17.6-18.6 18.2	6.2-7.6 6.9	52-63 56	23-31 27	3

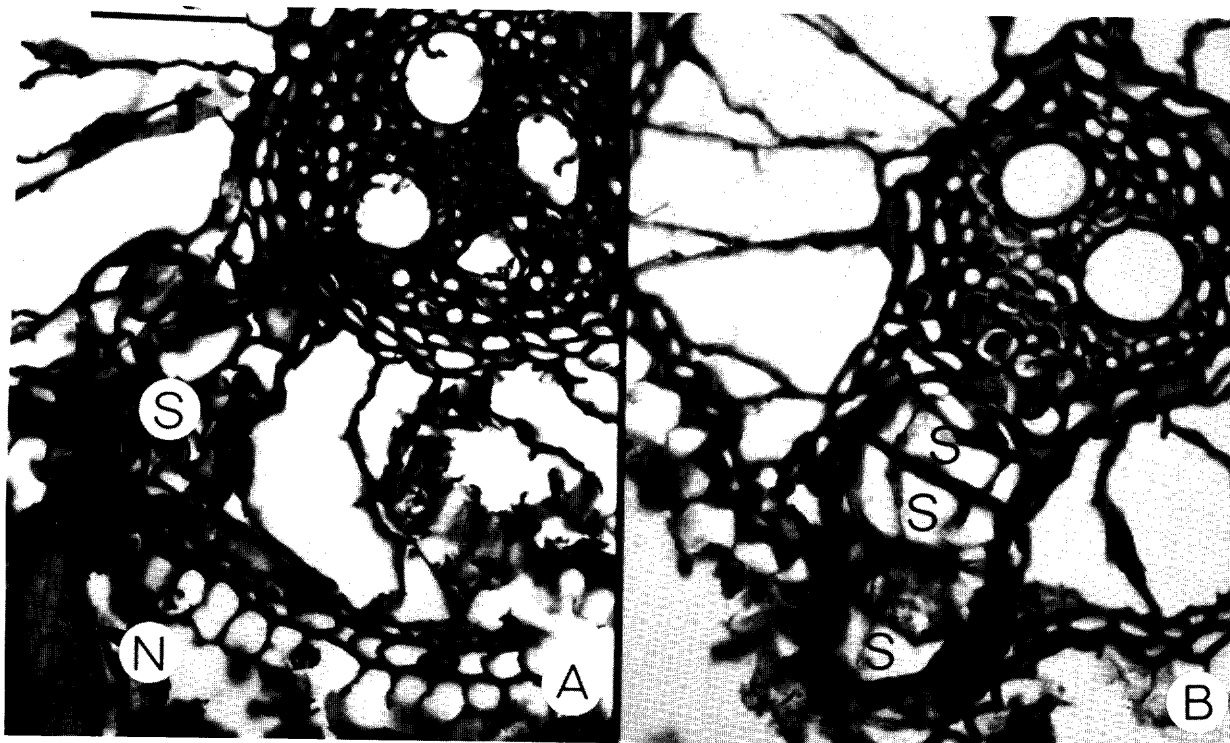


Fig. 6. Cross sections of a Panicum rigidulum root infected with Heterodera graminophila. A) Nematode (N) feeding on syncytium (S). B) A well defined syncytium (S). Scale bar = 35 μ m.

Symptoms and Anatomical Alterations: Only slight growth reduction is reported on Barnyard grass infected with H. graminophila (1). Under greenhouse conditions, P. rigidulum plants heavily infected with this cyst nematode were stunted and had chlorotic leaves. Because this species is limited in distribution its economic importance on range land grasses and cultivated crops, such as rice, is not known. Specialized cells (syncytia) (Fig. 6) induced by nematode feeding are observed in the stele of P. rigidulum roots infected with H. graminophila. In contrast, roots of Barnyard grass do not show evidence of syncytia when parasitized by this nematode (2).

Survey and Detection: Range grass lands or lands destined to rice culture should be surveyed for stunted Barnyard grass, Johnson grass or P. rigidulum plants. Soil and root samples collected from these plants should be submitted to the Bureau of Nematology for nematological analysis.

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Contribution No. 385, Bureau of Nematology

This publication was issued at a cost of \$ 805.84 or \$ 0.24 per copy to provide information on proper recognition of plant pests. PI89T-44